Deer Habitat Research Needs in California

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This paper is ...arch needs prepared jointly by ...epartment of Fish and Game and an er... Forest and Range Experiment Station ...e exhaustive. Instead, it pinpoint... might make major contributions to deer habitat improvement and management. Some of these areas are now being studied; others are not. We feel that increased research in the deer habitat field is needed.

New knowledge, gained from research such as that suggested in this paper, will permit land and game managers to more fully integrate deer habitat improvement practices into management of natural resources.

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CONTENTS

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Deer managers have been primarily concerned in recent years with the problems of surplus animals and of reducing damage due to overuse of deer ranges. This is as it should be. Balancing deer numbers to range-carrying capacity is of first priority. Only slightly less urgent is the need to develop techniques for improving deer habitat.

California is a diverse State, and possibilities for improving deer habitat are many and varied. The mountainous terrain, the influence of the Pacific Ocean, and the great length of the State cause wide variation in climate. More than two-thirds of the precipitation occurs in northern California. Along the North Coast, most of the precipitation is rain; at higher elevations of the Sierra Nevada and Cascade Ranges, most of it falls as snow. In parts of the North Coast, precipitation exceeds 80 inches; in the Mojave Desert, it averages less than 3 inches a year. Air temperatures vary widely--influenced by elevation, latitude, and proximity to the Pacific Ocean. The wide variation in soils affects both the distribution of plants and the nutritional value of browse plants (Burcham 1957).

Because of these differences in climate and soils, methods for improving deer habitat in one part of California may have little value in other parts. To simplify this discussion of the needs in deer habitat research, we will consider only the broad vegetation types that are most important to deer. These types are found in three broad geographic zones: timber, chaparral, and Great Basin.

TIMBER ZONE

Changes brought about by man in the timber zone have been of paramount importance in increasing deer abundance in California. Timber chaparral is perhaps the most important type to deer in the timber zone (fig. 1). This brush type lies above 3,000 feet elevation in the climatic zone suitable for timber. It should not be confused with the true or chamise chaparral found at lower elevations. Extensive brushfields occur on soils too shallow for timber, and on timber soils as a secondary succession after disturbance. Common browse species found in this type include: deerbrush (Ceanothus integerrimus), lemmon ceanothus (C. lemmoni), manzanitas (Arctostaphylos spp.), mountain misery (Chamaebatia foliolosa), mountain whitethorn (C. cordulatus), snowbrush (C. velutinus), western serviceberry (Amelanchier alnifolia), wild cherry (Prunus spp.), and several shrub oaks (Quercus spp.).

In the humid North Coast forests, browse and other valuable herbaceous plants invade rapidly after logging or fire, or both. The nutritional content of browse on logged areas is higher than in undisturbed timber--largely because of increased sunlight. Nutritional values of browse after fire are even higher owing to the fertilizing effects of the ash. Deer numbers increase rapidly for 5 to 10 years after disturbance, remain level for about another 5 years, and then start to decline as the shrubs grow out of reach and the nutritional quality declines (Brown et al. 1961; Cowan et al. 1950; Einarsen 1946; Longhurst 1961; Taber 1961).

Although the ecological processes leading to overmature, overdense, and low-quality feed are more rapid in the humid North Coast region, many of the same problems exist in other parts of the conifer zone. Brush stands, too dense for deer or timber regeneration, have taken over after logging and fire in the ponderosa pine, Douglas-fir, and true fir types.

ECOLOGICAL SUCCESSION

What sort of research is needed in the timber zone? First, we need to know the ecological succession on a wide variety of timber sites. Perhaps one good approach is to survey present vegetation on areas with known logging history. Autecological study of individual browse species is also needed. Some basic ecological information is available, but much more is needed.

Research is also needed to develop methods for slowing brush succession on logged areas. Varying the intensity of browsing is one possibility. Relatively heavy browsing holds some browse species in usable, palatable, and nutritious form (Gibbens and Shultz 1963). We need studies: (a) to test further the idea that browsing by livestock or deer can shape plants, and (b) to determine how to achieve the necessary level of browsing. Changing the size or pattern, or both, of logged areas may prove to be the most feasible means of influencing the degree of browsing. Mechanical and chemical means for shaping browse plants and for opening up brush stands are another possibility which warrants study.

Because of the demand for water and additional power, many areas that were formerly deer winter ranges are being taken over for large reservoirs (fig. 2). Other lands must be developed to compensate for the inundated range, or the number of deer will drop to adjust to the reduction in range carrying capacity. To prevent the deer population from decreasing, adjoining forests may have to be converted to brush types more suitable for deer. Research is needed to develop means of doing this.

DEER-TIMBER CONFLICTS

Intertwined in all timber-deer studies is the problem of meshing timber production needs with deer production. Heavy deer use on young timber plants sometimes hinders the re-establishment of timber after logging or fire. One solution is to reduce the deer population to a level where the use on timber plants is tolerable. Studies are needed to determine proper deer stocking for the different timber sites. Repellents to protect young timber plants is another possibility--one which the U. S. Fish and Wildlife Service is investigating. Fencing is a proved but expensive means of eliminating damage from deer.

Although deer do eat tree seedlings and young timber plants, they also feed on competing vegetation, and perhaps aid seedling survival.

Figure 1.--Dense timber chaparral, Mineral King Refuge, Tulare County, California.

Jack Slosson, Calif. Dept. of Fish and Game

Figure 2.--Clearing of former deer winter range for water storage, Trinity Reservoir.

Cooper believes that deer damage to young timber plants is limited to a period of only a few weeks during the year.[1]

Cattle grazing is held by many to be completely incompatible with timber production. But Sindel found that careful timing of cattle grazing on his Ranger District in the Tahoe National Forest held deer-brush plants in check and reduced competition with conifer transplants (U. S. Forest Service n.d., a.). Cattle did not browse the transplants until late in the grazing season and then suddenly switched from deer-brush to conifer transplants. Sindel related this change to the seasonal palatability of the two plants. Cattle can be removed at a certain date to protect timber reproduction, but deer cannot.

We suspect that during the time deer damage conifers, the trees may be more palatable to these animals than are other plants on the area--even though these other plants have higher palatability during the rest of the year. If buffer plants--species more palatable during the period of damage--could be encouraged or introduced to the area, injury to young conifers might be minimized. First, we need to know the period when the conifers are being damaged. Next, we need more information on the seasonal palatability of the various browse species and the factors that influence change in palatability.

Possible buffer plants--oak trees, for example--are sometimes removed to favor conifers. Removal of oaks should be evaluated to determine if the ecological and long-term effects are desirable and to determine whether the reduction of deer food (leaves and mast) by oak removal results in increased depredation on the conifers.

SUMMER RANGE

A problem which warrants special mention is that of the deer summer range in the Sierra Nevada (fig. 3). To date, most of the research effort in deer habitat has been placed on winter range problems. There are strong indications that serious summer range problems exist in the Sierra Nevada (Adams 1959). Personnel from the Sierra National Forest and California Department of Fish and Game have observed losses of food plants on the summer range. Other evidence of the problem is the relatively poor fawn-to-doe ratio when the deer move onto the winter range. For example, the San Joaquin herd had a fawns-per-hundred-doe ratio of 22 in the fall of 1961; 35 in the fall of 1962; and 60 in the fall of 1963, which is still relatively low when compared to some of the Great Basin ranges deer herds. Three herds in the Modoc unit, in the fall of 1962, had fawns-per-hundred-doe ratios of 75, 80, and 99.

Research is needed on the Sierra Nevada summer ranges to determine the causes for the loss of plants and for low fawn crops. Perhaps the summer range was enhanced for deer during the earlier era of destructive logging. Present logging practices and increased fire control

[1]Personal correspondence with D. W. Cooper, Farm Advisor, Agricultural Extension Service, University of California, Eureka, Calif., Jan. 6, 1965.

may not be as conducive as earlier practices to production of deer feed although they are more desirable for timber production. We need to determine the most important summer forage species for both deer and livestock and the reproduction, growth, and habitat requirements of these species. We also need to determine the effects of grazing use by both deer and domestic animals on these plants.

Studies by University of California scientists on the San Joaquin deer herd's summer range indicate that Ceanothus cordulatus (mountain whitethorn) is the most important browse species. Most productive summer deer ranges in the West have a variety of browse, forbs, and grasses; deer have a choice of diet. Possibilities for providing an even more varied diet on Sierra summer ranges need investigation. Mountain meadows perhaps afford the best opportunity for increasing herbaceous deer feed. But there is a difference of opinion as to the importance of mountain meadows to deer. Some workers feel that mountain meadows are extremely important as fawning areas. University of California researchers, in contrast, found that nearly all of the fawning occurred on side hills, and that attempting to study fawns on mountain meadows by spotlighting proved futile.

Studies of methods of regenerating the better browse species on the summer range are also needed.

CHAPARRAL ZONE

Chaparral occupies dry slopes and ridges of thin soils between 1,000 and 4,000 feet elevation (fig. 4). Chamise (Adenostoma fasiculatum) is the most characteristic and widely distributed brush species. Other common species are: California coffeeberry (Rhamnus californica), California laurel (Umbellularia californica), California scrub oak (Quercus dumosa), California yerba santa (Eriodictyon californicum), ceanothus (Ceanothus spp.), chaparral pea (Pickeringia montana), hollyleaf redberry (R. crocea var. ilicifolia), manzanitas (Arctostaphylos spp.), scrub interior live oak (Q. wislizenii var. frutescens), western redbud (Cercis occidentalis).

Chamise and mixed chaparral are the two main chaparral types. Species composition of chaparral differs from one climatic region and soil type to another. Stand composition is important in considering improvement possibilities--especially where controlled burning is a possibility, since some species sprout and others reproduce only by seed (Sampson and Jespersen 1963).

Probably more research of direct value to deer management has taken place in the chaparral type than in any other vegetation type in California. Biswell's project, financed by California Department of Fish and Game, helped develop controlled burning and mechanical methods for opening up dense brush stands (Biswell 1961). This opening up of the dense brush results in a considerable increase in the deer herd.

Taber (1956) suggested three reasons for improved quality of feed in the open brush which he felt accounted directly for deer increases:

Figure 3.--Dead buckbrush (*Ceanothus cuneatus*) on summer deer range.

Henry Hjersman, Calif. Dept. of Fish and Game

Figure 4.--Chamise brush field in Santa Barbara County.

(a) more herbaceous understory which is high in protein during winter and early spring; mature, dense brush stands seldom support much of a herbaceous understory; (b) shrubs on opened areas are kept within reach of deer through browsing pressure so that leaves, which are higher in protein than stems, can be selected; and, (c) browsing of hedged shrubs over a long period of time stimulates regrowth which is high in protein.

CONTROLLED BURNING

Knowledge of the ecological processes involved in controlled burning is incomplete (Burcham 1959). What are the long-term effects of the repeated controlled burning necessary to maintain chaparral in the open shrub land most desirable for deer? Frequent burning favors sprouting species (Biswell 1961), but we know little about the long-term effects of frequent burning on the soil.

BRUSH CONVERSION

If young brush sprouts are browsed too closely, the plants die in a few years; if not browsed enough, the shoots soon become harsh and unpalatable and grow out of reach of the deer (Reynolds and Sampson 1943). Some guidelines are available for distribution of opened areas and the percentage of total area it is necessary to convert to open brush to achieve proper browsing (Biswell 1961; Biswell et al. 1952). Evaluation and improvement of these guidelines is needed along with studies to determine if livestock can be used to supplement deer browsing (Gibbens and Schultz 1963).

Jay Bentley, in charge of the Pacific Southwest Station's brush-conversion studies, has found that treatment of brush with diluted solutions of brush-killer chemical will kill part of the top growth but not the entire plant. These are preliminary results and need further testing, but possibly herbicide treatments can be developed for shaping browse plants into usable form.

Most brush areas in California are high fire-hazard areas. Fire fighters find it difficult, and sometimes impossible, to control fires raging through extensive brush stands. One method of reducing fire hazard in brush areas is to convert strips of brush along ridge tops to grass so as to break the large brushy areas into controllable units. These strips--known as fuel-breaks--permit more rapid movement of fire fighters and equipment and an opportunity to backfire (Bentley and White 1961) (fig. 5).

BROWSEWAYS

The U. S. Forest Service and the California Department of Fish and Game have cut strips--called browseways- through the chaparral brush in southern California--specifically to benefit large and small game. Brush has been crushed on some of the northern forests to eliminate old browse material and to encourage fresh sprouting and

more edible growth. These techniques need further refinement and testing in other brush types (U. S. Forest Service n. d., b.). Strips cleared of brush provide edge and type interspersion as well as make hunter access easier. It may be feasible in some cases to manage and manipulate an additional strip of "edge" for maximum production of palatable, nutritious browse. Livestock grazing, mechanical and chemical treatments, and any other promising methods should be investigated.

GREAT BASIN ZONE

The Great Basin Zone of California lies east of the Sierra Nevada Cascade Divide. Big sagebrush (Artemisia tridentata) is the most widespread and typical brush species in this arid region. Other important deer browse species include bitterbrush (Purshia tridentata), curlleaf mahogany (Cercocarpus ledifolius), and wild cherries and plums (Prunus spp.) (Longhurst et al. 1952). Bitterbrush is considered to be an important species on most of the Great Basin deer winter ranges.

Many of the better browse plants on important deer winter ranges are decadent and are not reproducing (fig. 6). Past and current overuse of the browse by both deer and livestock has contributed and is contributing to the drop in browse production. This, however, is not the whole story. Juniper and pinyon pine appear to compete directly with the better browse; juniper in the northern half of the Great Basin region and pinyon pine in the southern half. Competition between grass and browse reproduction is another problem.

PINYON-JUNIPER PROBLEMS

The Pacific Southwest Station has nearly completed the first phase of a study of juniper ecology and the relationship among juniper, browse, and grass. Other studies are needed on methods of removing or thinning juniper and on determining the effects of such treatment on the browse stand.

The California Department of Fish and Game, in cooperation with this Station, is starting a study of the effects of thinning and complete removal of pinyon pine on browse stands. This study is being conducted near Bishop, California.

SAGEBRUSH REMOVAL AND CONVERSION

Converting sagebrush to grass is an accepted range improvement practice in the Great Basin zone. The immediate and long range effects on big game of sagebrush removal and conversion to grass should be determined. Similar information is needed where extensive sagebrush stands have been defoliated by insects, such as the sagebrush defoliator (Aroga websteri) (Hall 1963). Little seems to be known about the natural rate of re-establishment of sagebrush or the carrying capacity of replacement plants that might temporarily replace it.

Figure 5.--Fuel-breaks, constructed primarily for fire hazard reduction, also benefit deer by creating edge and variation in type of vegetation.

Figure 6.--Overused and decadent bitterbrush plants do not reproduce.

LIVESTOCK GRAZING

Heavy use by livestock in the past is thought to have been largely responsible for changing the climax bunchgrass association to a sagebrush-bitterbrush association on some of the winter ranges in the Great Basin region (Longhurst et al. 1952). This change has benefited deer. With reduced livestock use on the ranges, bunchgrass appears to be increasing to the detriment of the browse (Hubbard and Sanderson 1961). There is a possibility of using livestock as the means to again reduce bunchgrass and other competing plants, thus making growing space available for young browse plants. To investigate this possibility, the Pacific Northwest Forest and Range Experiment Station, at Portland, Oregon, has built three large enclosures in the Great Basin region of Oregon near Silver Lake. These units have been stocked with deer only, deer and livestock, and livestock only.

The Pacific Southwest Station plans to complement the Pacific Northwest Station's work with smaller grazing studies to answer specific questions. Before livestock grazing can be prescribed as an effective means to manipulate vegetation so as to favor browse, we need to know if we can reduce bunchgrass without killing the browse. One possibility is to graze cattle earlier than is the common practice. The newly sprouted grass is then relatively easily damaged and perhaps palatable enough to permit relatively heavy grazing without undue damage to the browse. This hypothesis will be tested in series of 5-acre grazing units now being installed on both the Silver Lake range in Oregon and the Devil's Garden range in Modoc County, California.

BROWSE RESEEDING

In many areas in the Great Basin region, the better browse has been nearly wiped out by wildfire or mismanagement in the past. There is no alternative here but to artificially re-establish the browse (fig. 7). From 1952 to 1962, this Station conducted studies of methods for seeding bitterbrush and other important browses. They were financed by the California Department of Fish and Game under the Pittman-Robertson program.

Other workers have conducted similar programs under different conditions in other parts of the West. Reseeding techniques were developed and are now being used by land management agencies (Brown and Martinsen 1959; Holmgren and Basile 1959; Hubbard 1964). Reestablishing browse plants is only a part of the problem. Many successful plantings have failed because of damage from rodents, rabbits, livestock, or deer. More information is needed on the ways to protect these plantings and the length of time necessary for protection.

Figure 7.--Artificial establishment of browse is necessary where the better browse has been wiped out by wildfire or past mismanagement.

GENERAL RESEARCH NEEDS

Turning now to research needs of general interest rather than those peculiar to a particular geographic region or vegetative type, we find a need throughout the West for a thorough understanding of the ecology of individual browse species and browse communities. This knowledge is basic to manipulation and to management of vegetation.

Refinement of old techniques and development of new ones for measuring browse is needed. Adapting methods developed for sampling grass or trees to browse sampling is not always satisfactory. Development of specialized methods for browse sampling requires extensive study.

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